FIRE HISTORY AND FUELS ASSESSMENT, SOUTH FORK SALMON RIVER

KRASSEL RANGER DISTRICT

PAYETTE NATIONAL FOREST

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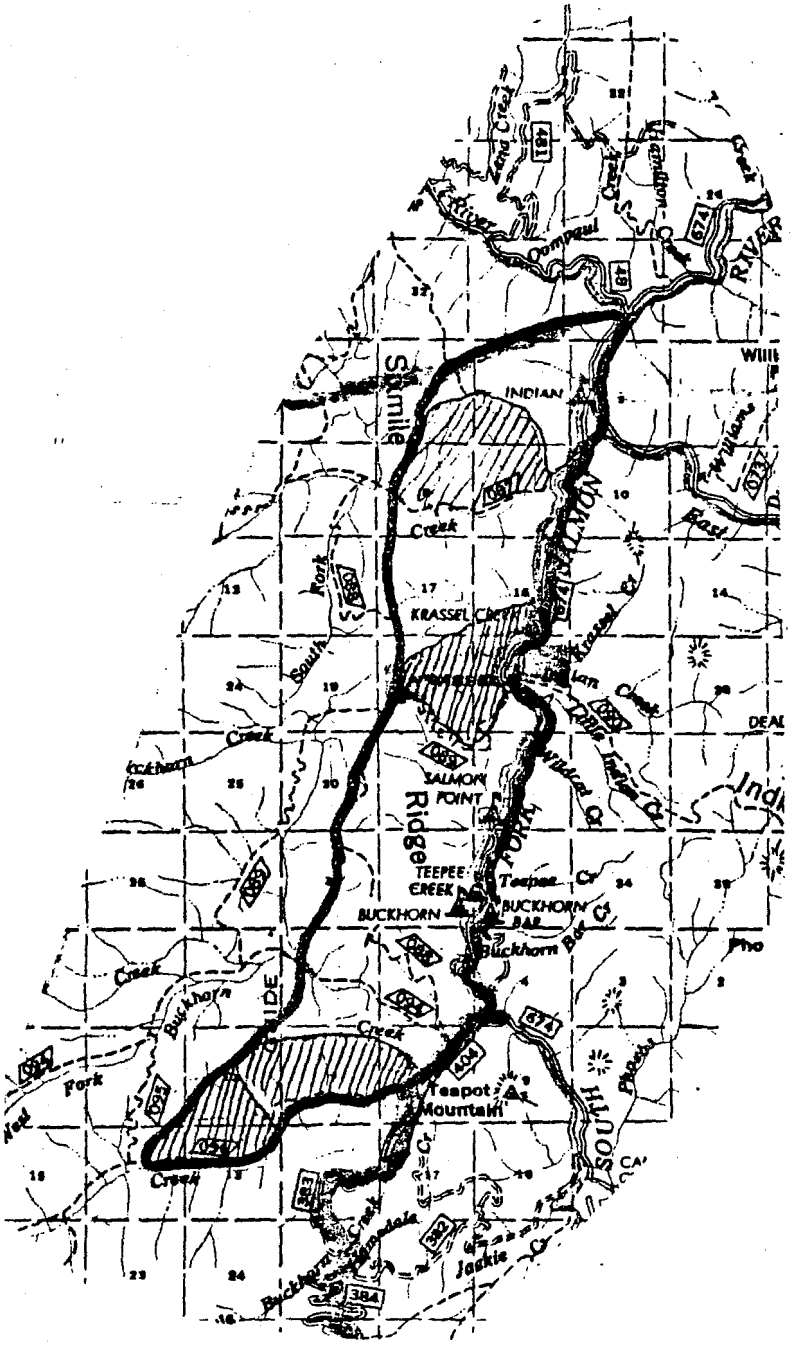
Introduction

In July 1988, a fire history and downed fuels assessment was conducted in the South Fork of the Salmon River drainage, Krassel Ranger District (Payette National Forest). Overall objectives were to characterize fire's historical role and the downed woody fuel complex within the South Fork's major forest types. Field sampling was designed to provide baseline data for fire management planning in a large area containing 4 proposed prescribed burn units, between the Fitsum Creek and Buckhorn Creek drainages (fig. 1).

Study Area

The study area contains lightly- to moderately stocked uneven-aged stands of ponderosa pine and Douglas-fir on dry aspects, and relatively densely stocked even-aged stands of Douglas-fir, grand fir, and western larch (Larix occidentalis) on moist aspects. Because prescribed fires are planned primarily for the ponderosa pine zone, field sampling focused on the area's low- and mid elevation forests (3500-6000 ft.), specifically, the ponderosa pine (Pinus ponderosa), Douglas-fir (Pseudotsuga menziesii), and grand fir (Abies grandis) habitat type series (Steele et al. 1981). Major habitat types on dry aspects are ponderosa pine/bunchgrass, Douglas-fir/snowberry (Symphorocarpus spp.), and Douglas-fir/bitterbrush (Purshia tridentata). Douglas-fir/pinegrass (Calamagrostis rubescens) and Douglas-fir/ninebark (Physocarpus malvaceus) are common habitat types in east-facing draws, while grand fir/huckleberry (Vaccinium globulare) is the predominant type on moist aspects throughout the study area (see habitat type map enclosed with this report).


Sixmile
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Methods

The methods of Barrett and Arno (1988) were used to document area fire history. Five transects, totalling about 15 miles of continuous inventory, were run through the proposed Buckhorn, Doehorn, Krassel View, and Fitsum Creek prescribed burn units (fig. 1). On dry aspects subject to surface fires, fire scars were increment bored on multiple-scarred ponderosa pines to obtain estimates of surface fire frequency in uneven-age stands. On moist aspects subject to stand-replacing fires, pith samples were taken of the stand-initation years of even-aged stands, to obtain estimates of crown fire frequency.

In the office, a habitat type map was first developed by examining stand tree plot data and then extrapolating the occurrence of major types within the study area. The increment core samples were sanded then dated with a binocular microscope to produce the study area's Master Fire Chronology. The next step was to map the study area age class mosaic (fire history age class map) by plotting the locations of pith and fire scar samples, then using aerial photographs to trace the extents of even-age stands that became initiated after the fires.

The increment core data were then used to interpret stand fire frequencies for the various forest types. Surface fire frequency for dry-site ponderosa pine stands was first estimated by boring fire scars on old multi-scarred pines; approximate fire years were determined for a given tree's most recent fire scar, then for the oldest scar on the catface. The number of years in the intervening period was then divided by the number of fire intervals on the catface, producing an estimate for MFI. Next, crown fire frequency was estimated for the moist aspects by examining age class chronologies (Barrett

and Arno 1988); pith samples were taken from even-age trees within the current canopy, then pith samples were taken from any older veterans that had survived the site's last stand-replacing fire, producing an approximate chronology of successive stand replacing fires. Finally, the data from tree inventory plots in each sample stand were examined relative to the stand's fire history to obtain interpretations about fire's role in stand succession.

Downed woody fuels also were photographed at each sample site. Appraisals of the downed fuel complex were made in the office using Fischer's (1981a, 1981b) fuel photo series. The following fuel categories were examined: 1) stylized fuel model, 2) fuel loadings, by 0-3" and 3+" diameter class, 3) mean duff depth, and 4) fire potential rating (rate-of-spread, intensity, torching, crowning, and resistance-to-control).

Results

Thirty-eight stands were sampled in the study area, yielding 113 increment core samples of area age classes and fire-scars. Maximum tree ages found within the area's dry ponderosa pine stands range from about 200 to 450 years, while the oldest fire-initiated even-age class found on moist aspects was 377 years old (a larch/grand fir stand on the west-facing slope of Krassel Knob had regenerated after a fire in about 1611). Most of the study area's even-aged stands, however, are less than 100 years old, having regenerated after 2 relatively widespread fires in the early 1900s.

Study Area Age Class Mosaic. Aerial photographs and the increment core samples indicated that the study area has a relatively uncomplex age class mosaic, due primarily to major fires in 1901 and 1919. The age class mosaic is characterized by: 1) small- to moderate-size densely stocked even-aged stands

on moist aspects, and 2) moderate- to large size relatively open uneven-aged stands on dry aspects. The fire history age class map (enclosed with this report) shows that moist even-age stands in the study area generally are between 50 and 300 acres each, suggesting the typical maximum sizes of past stand-replacing runs. Moreover, the abrupt transition in stand structure between moist and dry aspects produces very different fire behavior during the same fire event. For example, in 1901 and 1919 low intensity surface fires were widespread in the dry ponderosa pine stands adjacent to moist aspects that experienced crown fire. Nearly half of the study area is occupied by dry ponderosa pine stands but the area age class mosaic is well dissected by moist even-age stands (east and north aspects). Therefore, in terms of economical fire control, spring burning over relatively large south slope areas is feasible because the forest mosaic contains numerous moist aspects that serve as natural fuel breaks.

Three major age classes occupy the study area (see enclosed age class map), and these are listed below in order of prevalence:

1) fires in 1901 and 1919 replaced stands on about 3000 acres (29% of the study area); the 1919 fire burned largely north of the West Fork of Buckhorn Creek and the 1901 fire burned south of that drainage, in the Buckhorn and Doehorn prescribed fire units. The locations of fire-scarred ponderosa pines, however, suggest that these fires also burned as surface fires over as many as 5000 additional acres, thus the 2 fires burned nearly 80% of the study area;

2) the study area's current major old growth class regenerated after a fire in about 1808; this age class occupies about 3400 acres (about 33% of the study area) and is well dispersed

within the study area (evidently much of this age class was replaced by the fires in 1901 and 1919);

3) the field sampling produced evidence of an older age class that regenerated after a fire in about 1611 (primarily west and southwest of Sixmile Ridge in the Buckhorn Creek basin); it was not possible to estimate the areal coverage of this fire because subsequent fires destroyed evidence of the 1611 age class. The relatively widespread sample locations, however, suggest that the 1611 fire burned substantial acreage.

As discussed later in this report, data on age class patterns can be useful for wildfire- and prescribed fire planning. For example, when combined with information on historic fire frequency and typical downed fuels in stands, an examination of the mosaic will suggest which age classes currently are the most flammable. Also, because fire scars indicate when the last fires passed through a given ponderosa pine stand, the data can be used to determine which prescribed fire units would be the most logical selections for re-introducing surface fire to enhance wildlife habitat and other management goals.

Stand Fire Frequencies. Table 1 presents fire occurence data for 15 of the most useful sample stands, stratified by aspect, cover type, and habitat type. Increment core samples from catfaced ponderosa pines suggest that surface fires occurred in south-facing stands on an average of every 16 to 35 years (7-stand mean: 24 yrs.). Eight years was the shortest interval found for successive surface fires in a stand but some fires undoubtedly occurred after even shorter intervals (light surface fires occasionally do not scar trees). Importantly, most of the study area's ponderosa pine stands have not experienced fire in 69 years or more (1919 fire), which is the longest fire interval experienced by

Table 1. Fire History data for 15 stands, Krassel Study Area.

Stand[1]	Asp.	Elev.	Cover Type[2]	Hab. Type	Fire Scars	Max. Interval Lgths.	Last Fire (yrs)	MFI
1	S	4280	Pipo	Psme/Syor	4	23-69	69	35
2	S	3920	Pipo	Psme/Phma	7	14-69	69	36
3	NW	4640	Laoc	Abgr/Vagl	1	60-135	87	-
4	N	4880	Abgr	Abgr/Vagl	1	82-111	87	-
5	SW	5380	Pipo	Psme/Phma	10	17-87	87	16
6	S	5520	Pipo	Psme/Phma	2	87-93	87	-
7	NW	5710	Psme	Abgr/Vagl	1	69-153	69	-
8	SW	5620	Pipo	Psme/Caru	5	16-69	69	21
9	NW	5520	Laoc	Abgr/Vagl	0	152-225	152	-
10	SE	5600	Pipo	Psme/Caru	7	8-69	69	16
11	NE	5200	Laoc	Abgr/Vagl	1	69-111	69	-
12	S	5340	Pipo	Psme/Syor	2	30-69	69	-
13	SE	4800	Pipo	Psme/Syor	6	18-69	69	22
14	SW	4620	Pipo	Psme/Phma	5	16-69	69	19
15	NE	4080	Abgr	Abgr/Vagl	0	180+	180	-

South Slope Fire Interval Range (MFI): 16-35 yrs
North Slope Crown Fire Intervals (Multiple Site Average Fire Interval): 128 yrs

[1] Stand locations are shown on the stand age class map.

[2] Abbreviations follow Steele et al. (1981) habitat type acronyms.

the area's dry-site stands within the last 3 centuries. This is a frequent finding of fire history studies in the region, indicating that efficient fire suppression has substantially lengthened fire intervals in most low elevation forest types.

For stands on moist aspects, the data suggest that stand-replacing fires recurred at intervals ranging from 60 to 225 years (5-stand mean: 128 yrs). Many of the study area's north-facing stands regenerated after the early 1900s fires, thus these stands are still in the relatively early stages of succession. Consequently, 50 years of fire suppression have not substantially influenced most moist-aspect sites. However, the few remaining old growth stands (180+ yrs) on north aspects now appear to be approaching the upper threshold of their fire cycle (see age class map).

Fuel Photo Appraisal. Fischer's photo series were used to analyze 61 fuel photographs that were taken along the sample transects. Total fuel loads usually were relatively light (table 2) because of the inherently low biomass productivity on arid sites, and, because most of the study area burned in the early 1900s. The old growth ponderosa pine stands (ponderosa pine and dry Douglas-fir habitat types) generally had total fuel loads of less than 4 tons per acre. These stands also had low to medium overall fire potential, with rate-of-spread usually in the medium to high range. Light tree stocking levels within these dry stands also produced low ratings for the torching and crowning categories. Therefore, unlike more-moist ponderosa pine forests elsewhere in the Northern Rockies, fire's absence over the past 7 decades generally has not increased downed fuel hazards or produced dense thickets of understory tree regeneration.

Table 2. Typical range of fuel characteristics for stands in the Krassel study area, based on 61 fuel photographs.

Cover Type	Std Age	Fuel Model	Fuel Loading (tons/ac.) 0-3"	3+	TOTAL	Mean Duff (in.)	Fire Potential Rating[3] ROS	INT.	TORCH.	CRWN.	CTRL
Low elevation riparian zones/low moist aspects:											
DF/GF	100	10	5.3	16.9	22.2	1.8	M	M	L	L	M
L/GF	100	8	1.8	11.0	12.8	2.7	M	M	L	nil	M
Mid to high elevation moist aspects:											
L/DF	60	8	4.5	.8	5.3	2.3	M	M	M	L	M
L/GF	180	8	4.8	21.8	26.6	1.1	M	M	L	L	L
Low to mid elevation dry aspects:											
PP	67	9	1.4	2.4	3.8	.6	M	L	L	L	L
PP	137	9	1.0	.1	1.1	1.5	M	L	L	nil	L
High elevation (<6000 ft) dry aspects:											
PP/DF	60	8	3.9	.6	4.5	2.0	M	M	L	L	L
DF/PP	75	8	2.4	3.9	6.3	1.4	L	L	L	L	L
PP	80	10	6.7	9.7	16.4	2.1	M	M	H	H	L
PP	103	8	2.8	3.8	6.6	.9	L	L	nil	nil	L
PP/DF	128	8	1.7	7.7	9.4	1.6	M	L	L	L	M
PP	300	2/8	2.5	5.3	7.8	1.0	M	L	L	L	L

[3] Category abbreviations are "rate of spread, intensity, torching, crowning, and resistance to control", with "low, medium, or high" ratings. Fire potential also can be assessed by referring to the fire history age class map.

The heaviest fuel loadings were found within the few remaining old larch/grand fir stands on moist aspects (grand fir/blue huckleberry habitat type), stands generally in excess of 180 years old (see habitat type and age class maps). Total fuel loads in old growth moist stands usually were between 20 and 30 tons per acre. Overall fire potential generally was low to medium, but the stands usually have medium potential for scorching and crowning. The historic fire intervals suggest that these 180+ year old stands are now near the upper end of the natural fire cycle--the mean interval for stand-replacing fires was 128 years and the maximum interval found during sampling was 225 years.

The fuel analysis also supports the interpretation that stand-replacing fires did not often occur on moist aspects before 100 years of stand development. The fuel data suggest that the study area's youngest stands (<70 yrs old) currently have low overall fire potential. Torching, crowning, resistance to control and other categories consistently were within the low range and the total fuel loads usually were substantially less than 20 tons per acre.

Management Implications.

Overall, the fire history and fuels data suggest that fire suppression has not yet markedly influenced stand succession in the Krassel area of the South Fork. However, suppression clearly has altered fire cycles within south-slope stands--the fire intervals for most of these sites currently are from 2 to 4 times longer than the pre-1900 intervals. None of the ponderosa pine sample sites have experienced a surface fire within the past 70 years or more, while pre-1900 intervals generally ranged from 8 to 30 years long. South-slope

aridity limits fuel buildups in ponderosa pine stands, but fire's absence has undoubtedly reduced the vigor of important wildlife browse species such as bitterbrush (Purshia tridentata), serviceberry (Amelancier alnifolia), and willow (Salix scouleriana). Field observations in ponderosa pine stands verify that many browse shrubs currently are overmature and have only limited value as wildlife browse.

In terms of fisheries habitat management and the potential for post-fire soil erosion, the fuels data suggest that fire severities and fire sizes in south slope stands will remain similar to those during the presettlement pattern. Aridity is the limiting factor controlling generally light fuel loads, thus assuring subsequent low intensity fires. In spite of the fact that fire has been absent for 7 decades, re-introduction of surface fires would not be expected to substantially increase soil erosion in stands.

Interpretations based on the fuels and age class data also can be useful in planning for area wildfires. The oldest stands near Krassel (see age class map) would experience the most severe fire behavior during summer drought. However, this area's predominance of young age classes, interspersed with the adjacent lightly fueled south slopes, reduces the potential for extensive crown fires. Most of the study area's even-aged stands are less than 300 acres each, suggesting the past maximum sizes of stand-replacing runs during drought conditions. Conversely, during spring south-slope burning the low-flammability of adjacent moist stands will serve as important natural fuel breaks and will help define fire perimeters.

The data also were used to evaluate the potential for prescribed fires within Krassel District's 4 proposed prescribed burn units. The Fitsum Creek and Doehorn units represent the most logical sites for re-introducing fire when

the primary goal is to return relatively large acreages of ponderosa pine forest to the fire cycle. These units each contain large percentages of dry aspect stands currently in need of surface fire. By contrast, the Buckhorn unit contains a substantial amount of young ponderosa pine stands initiated after fire in 1901 (see age class map). These lower-slope stands are relatively moist and overstocked, thus spring burns might not carry as well as in the more open mid-elevation stands (conversely the young stands would be prone to heavy scorching if fires were ignited during summer drought conditions). The proposed Krassel View unit contains a more diverse array of age classes and fuel types than the other 3 units--and fewer contiguous acres of any one stand type. Consequently the area along Sixmile Ridge's east face represents a logical selection for prescribed fire when spring burning on south slopes is the primary management goal, and when relatively small prescribed fires are desired.

In summary, the fire history and fuels assessment for the Krassel study area suggests that fire suppression has not yet markedly altered tree and fuel succession. However, where perpetuation of historic fire cycles and wildlife and fisheries habitat enhancement are major goals, application of prescribed fire represents a timely management alternative for the South Fork's ponderosa pine stands.

LITERATURE CITED

Barrett, S. W., and S. F. Arno. 1988. Increment borer methods for determining fire history in coniferous forests. USDA For. Serv. Gen. Tech. Rep. INT-244, Intermt. Exper. Sta., Ogden, UT.

Fischer, W. C. 1981. Photo guide for appraising downed woody fuels in Montana forests: Interior ponderosa pine, ponderosa pine-larch-Douglas-fir, larch-Douglas-fir, and Interior Douglas-fir cover types. USDA For. Serv. Gen. Tech. Rep. INT-97, Intermt. For. and Range Exper. Sta., Ogden, UT.

_____. 1981. Photo guide for appraising downed woody fuels in Montana forests: Lodgepole pine, and Engelmann spruce-subalpine fir cover types. USDA For. Serv. Gen. Tech. Rep. INT-98, Intermt. For. and Range Exper. Sta., Ogden, UT.

Steele, R., R. D. Pfister, R. A. Ryker, and J. A. Kittams. 1981. Forest habitat types of central Idaho. USDA For. Serv. Gen. Tech. Rep. INT-114, Intermt. For. and Range Exper. Sta., Ogden, UT.